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UTILIZATION OF WASTE WATER FROM REVERSE-OSMOSIS FOR PLANTION IN GCOE-JALGAON CAMPUS

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ABSTRACT

As per the growing population, demand for freshwater resources and the increasing use of reverse osmosis systems, the discarding of wastewater generated by these systems has become a vital challenge. This project explores the sustainable utilization of RO waste water for plantation purposes within a GCOE- Jalgaon college campus, aiming to reduce water wastage. RO waste water, generally rich in salts and minerals, is typically discarded, leading to environmental concerns and unnecessary wastage. This study investigate its potential use in plantation by analysing its composition and suitability for various plant species. This project involves designing and estimation of an efficient collection and distribution system and a market survey. Reducing freshwater consumption by substituting RO waste water for plantation in GCOE-Jalgaon college campus with estimate of pipe distribution system to improve the aesthetic and environmental quality of GCOE- Jalgaon college campus. RO wastewater from campus water purifiers will be channelled into a centralized storage tank using a network of pipes. The results indicated that possibility of using RO rejected waste water as a source of irrigation water. Campus has sufficient slope so that water will reach to each plant by gravity flow. RO waste water available is more than enough the requirement of the water for the system.Total RO waste water available nearly about 6250 liters/day (considered for Summer days) and daily use is 5000 to 5500 liters only. System is designed as per the standard procedure of design. The probable cost of project is Rs. 68,983 only.

KEYWORDS: RO Waste Water, Campus, Estimate, Storage Tank, Market Survey, Pipes

1. INTRODUCTION

Earth is known as a blue planet because Earth covers total 71% of water. From that 71% only 3% of water is freshwater and a small portion is accessible for drinking i.e. about only 0.3% of water is surface water use for drinking purpose other 2.5% of water is frozen in glaciers. Remaining 97% water is saline water present in oceans which is not useable for drinking because the saline water contain large amounts of salts. As per the growing population, water demand for drinking is also increases. These 0.3% water is contaminated by impurities present on the surface direct use of this water can cause various health issues. So most of the people and institutions are using reverse osmosis technique for the filtration of water. From this reverse osmosis the impurities are removed but this process can loose a large quantity of water as a waste water Hence, to utilize this waste water for plantation in GCOE-Jalgaon Campus this project is accomplished (WATER RESOURCES by JOSEPH HOLDEN,2013). Water is a essential resource for all living organisms, yet its availability is under constant pressure due to overuse, pollution, and increasing population. Reverse osmosis (RO) systems, commonly and check how much water is wasting for 1 liters of filtered water. Collecting information from the boys hostel and check the amount of waste water beyond 1 liters of filtered water knowing that 2.5 L waters waste on every 1L filtered water used for drinking water purification, are highly effective in removing impurities but produce a significant amount of wastewater, known as RO reject water. Typically, this wastewater is discharged without any reuse, leading to wastage and environmental, challenges. In a college campus setting, where RO systems are used widely, utilizing RO reject water for plantation can significantly enhance greenery while conserving valuable freshwater resources. RO wastewater contains raised levels of dissolved salts, mainly sodium chloride (NaCl), along with other ions such as calcium, magnesium, and sulfates. The concentration of these salts depends on the quality of the supply water and the operational effectiveness of the RO system. Limited nutrients necessary for plant growth, but may contain minerals that can benefit certain plant species. The composition of RO wastewater is a important factor when considering its reuse for irrigation. Project involves designing and estimation of drip irrigation system, storage tank and pipes. By using RO waste water, reduces the college water bills. To conserve water by using RO waste water for plantation in GCOE- Jalgaon campus. Layout of water distribution system in GCOE- Jalgaon campus by using AUTOCAD.

2. METHODOLOGY

Collection of the waste water from the RO. For 1liters filtered water 2.5 liters waste water is generated. For Main building 1000 liters water is filtered twice a day and for boys hostel 1500 liters water filtered twice a day.

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Water collect from	No. of RO	Water Quantity
Main Building for GCOEJ	2	5000L
Boys Hostel for GCOEJ	2	7500L

Total = 12500L

Table 1: Water Collection

2.1. TDS: TDS in water refers to the amount of total dissolved solid it contains Organic and Inorganic substances like minerals, salts in water. It is used for assessing water quality and water safety.

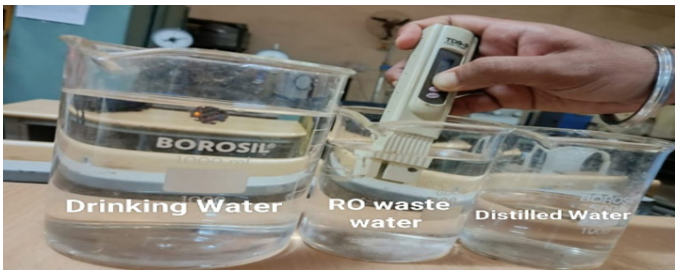

Fig 1: TDS Test

2.2. PH: The pH scale is used to measure the acidity of a fluid. The pH scale ranges from 0 to 14. A pH of 7 is neutral, whereas a pH result below 7 is acidic and above 7 is alkaline.

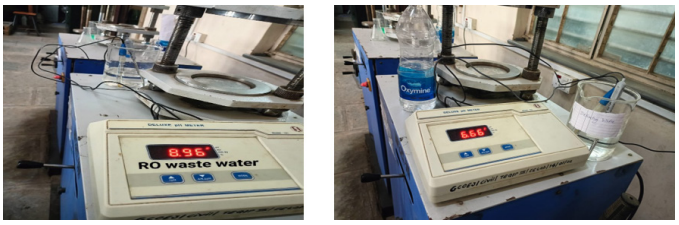

Fig 2: PH Test for RO Waste Water and RO Drinking Wate

2.3. Hardness: Hardness refer the presence of Ca2+ and Mg2+ ions in the water. Hardness are of two types

1-Temporary hardness -This is due to presences of Ca(HCO3) and Mg(HCO3) ions.

2-Permanent hardness –This is due to presence of CaCl2, MgCl2, CaSO4, MgSO4 ions.

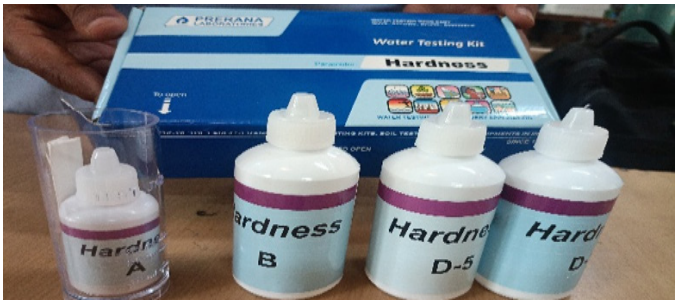

Fig 3: Hardness Test

2.4. Turbidity: Turbidity is a measure of how clear water is, or how much matter is suspended in it. It's an optical property of water that measures how much light is scattered by particles in the water.

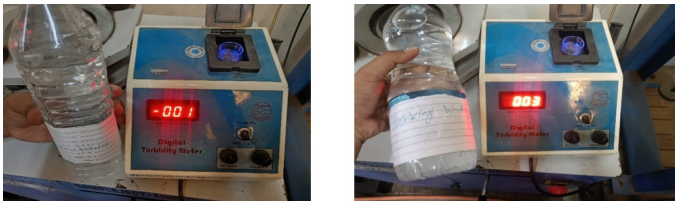

Fig 4: Turbidity Test for RO Waste Water and RO Drinking Water

2.5. Results

Test	RO waste water	RO drinking water
TDS	630ppm	50ppm
PH	8.96	6.66
Hardness	350ppm	50ppm
Turbidity	-1NTU	3NTU

Table 2: Results of test

2.6 Standard values for RO drinking and waste water

Test	RO Drinking Water	RO Waste Water
PH	6.5-8.5	6.5-9
TDS	50-500	500-2000
Hardness	0-200	200-600
Turbidity	<5	<1

Table 3: Standard result

3. CALCULATION

3.1. Calculation for Storage Tank:

For main building
RO waste water storage tank = 5000 L/day
Length = 2.58m
Width = 1.29m
Depth = 1.5m (including free board)

For boys hostel
RO waste water storage tank = 6000 L/day
Length = 2.82m
Width = 1.41m
Depth = 1.5m (including free board)

3.2 Calculation for Design of pipe:

When selecting pipes for an irrigation system, several key factors must be considered to ensure efficient and long-lasting performance. First, the pipes must be able to withstand the water pressure within the system to prevent leaks or bursts. Additionally, they should be appropriately sized to handle the required flow rate without causing pressure drops or inefficiencies. Corrosion resistance is also crucial, as pipes are exposed to water, soil, and other environmental elements that can cause deterioration over time. Durability is another important factor, as the pipes must endure varying environmental conditions and provide long-term service. Finally, cost plays a significant role in pipe selection, requiring a balance between

affordability, performance, and durability. In an irrigation system, different types of pipes are used based on their function and the system's overall design. Mainlines typically consist of larger diameter pipes, such as PVC or HDPE, which are used to transport water from the source to various parts of the irrigation system. Lateral lines, on the other hand, use smaller diameter pipes like PVC or PEX to distribute water to individual sprinkler heads or emitters. For drip irrigation, even smaller diameter pipes or tubing made of materials like PEX or LDPE are commonly used to deliver water directly to the root zone of plants. The selection of pipe type and size depends on factors such as the irrigation system layout, water demand, and prevailing environmental conditions. In irrigation systems, the selection of pipes is influenced by several critical factors to ensure effective and reliable operation. Pipes must be capable of withstanding the system's water pressure to prevent failures such as bursts or leaks. They should also be properly sized to accommodate the required flow rate, ensuring efficient water distribution throughout the system. Corrosion resistance is essential, as pipes are often exposed to water, soil, and various environmental elements that can degrade materials over time. Moreover, the pipes must be durable enough to endure harsh environmental conditions and provide long-term service. Finally, cost is a significant consideration, with pipe selection often requiring a balance between affordability, performance, and long-term durability.

3.2.1. Pipe Types:

1. PVC (Polyvinyl Chloride) pipes: Resistant to corrosion, durable, and affordable. Used for lifting water from water tank.
2. GI (Galvanized Iron) pipes: Durable, resistant to corrosion, but can be heavy and prone to scaling. Used for Main pipe.
3. CPVC (Chlorinated Polyvinyl Chloride) pipes: Resistant to corrosion, high-temperature tolerance, and suitable for irrigation systems. This material is used for volves.
4. Drip irrigation pipes: Drip irrigation pipes are designed to deliver water directly to the roots of plants, reducing evaporation and runoff. Flexible and easy to manipulate, drip irrigation tubing provides precise water delivery to each plant's root zone, minimizing water wastage. Used for Submain.

Design of Pipe	Submain Pipe	Main pipe
Velocity(v)	1.5m/s	
Discharge(Q)	0.000266m^3/s	
Area(A)	0.000137m^2	
Diameter(d)	14mm	63mm

Table 4: Design of Pipe

4. ESTIMATION AND CALCULATION:

According to the market survey and the state schedule rate (SSR), the rates of particular item are selected by considering factors like location, accessibility, and project complexity. Choose the rate that best reflects the project's specific conditions and requirements also comparing SSR rates with market survey rates to determine most suitable rate for each item. The SSR used in this work is of 2023-24.

L=length, B=breadth, W=width, Q=quantity, a= values for main building, b=values for boys hostel

Sr. No	Description		L	B	H	Q	Rate	per	Amt
1	Earth-work	a	3.04	1.75	1.77	9.4	140	m^3	1,316
		b	3.28	1.87	1.77	10.8	140	m^3	1,512
2	PCC bed	a	3.04	1.75	0.15	0.8	1,616	m^3	1,293
		b	3.28	1.87	0.15	0.9	1,616	m^3	1,455
3	Brick-work	a	8.6	0.23	1.5	3	1,588	m^3	4,764
		b	9.4	0.23	1.5	3.2	1,588	m^3	5,082
4	Plaster-ing	a	7.74	-	1.5	11.6	423	m^2	4,907
		b	8.46	-	1.5	12.7	423	m^2	5,373
5	Wproof-ing	a	7.74	-	1.5	11.6	605	m^2	7,018
		b	8.46	-	1.5	12.7	605	m^2	7,684
5	RCC	a	3.04	1.75	0.12	0.67	5,988	m^3	4,012
		b	3.28	1.87	0.12	0.74	5,988	m^3	4,432

Total = 48,848Rs

Table.No.5: Estimate Calculation

Sr. No	Description		Q	Rate	per	Amt
1	Motor	a	1/2hp	2800	nos	2800
		b	1hp	3800	nos	3800
2	Pipe (PVC)		25	75	m	1,875
3	Pipe (GI)		15	190	m	2,835
4	Dripping Pipe		1,900	4	m	7,600
5	Elebow		15	15	nos	225
5	Valves		10	100	nos	1000

Total=20,135Rs

Table.No.6: Estimate for pipe distribution

TOTAL AMOUNT= Total amount for construction of storage tank + Total amount for distribution system

=48,848 + 20,135

=68,983Rs

So, total amount required for these project is about 68,983 Rs.

6. CONCLUSION

Using RO wastewater for tree planting on a college campus is an excellent way to promote sustainability, conserve water, and create green spaces. While there are challenges related to water quality, with careful planning, suitable species selection, and appropriate irrigation techniques, RO wastewater can be effectively utilized for this purpose. This initiative not only helps in managing water resources efficiently but also serves as a model for responsible environmental practices within the campus community. Utilizing RO waste water for tree planting in college campuses is a sustainable and environmentally friendly practice. By adopting this approach, colleges can reduce their water footprint, promote biodiversity, and provide a unique learning experience for students.

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